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PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

1840. No. 26.

December 14, 1840.

Rev. J. H. TODD, D.D., Vice-President, in the Chair.

Dr. Apjohn read the following notice, by George J. Knox, Esq., of " some Improvements in the Voltaic Pile."

" The chief imperfection in the voltaic pile, its want of a constant uniform power of long duration, by which it is rendered almost useless as an instrument of research, having been overcome by the ability of Professor Daniell, the only thing that remained to render it efficient seemed to be, to increase its power; a desideratum accomplished by Mr. Grove, by substituting for copper and sulphate of copper, platinum and nitric acid. To give to Grove's battery a constancy of action equal to that of Professor Daniell's, would require an increase in the quantity of acids, (particularly the sulphuric,) into which the metals are immersed; but inasmuch as in galvanic batteries of the ordinary construction an increase of acid solution would require an increased distance of the metals from each other, producing a diminution of intensity, I endeavoured to obviate these disadvantages by the following contrivance. Porous vessels are fixed half an inch apart in lateral wooden supports, in which grooves are cut, to retain the zinc plates from touching; the porous vessels are filled with nitric acid, from a long glass tube, sealed at one end, and bent at the other at right angles. Along the side of the tube also holes are bored at distances corresponding to the distances of the porous vessels from each other; so that, upon pouring nitric acid into the tube, the vessels are all filled at the same moment; when filled, the entire apparatus is placed in a vessel containing sulphuric acid. The advantages of this arrangement were, that I had only two solutions to pour in, whatever number of alternations were employed; a sufficient supply of acid solutions to keep up a constant action for a length of time; and a distance between the plates scarcely exceeding the thickness of the porous vessel employed.

"The following experiments were undertaken with the intention of estimating the relative values of the different constructions of Grove's battery, recommended by Mr. Knight of Foster Lane, as far as respects the arrangement of the zinc and platina plates, when, to my surprise, I found the *same* quantity of electricity to be evolved when the zinc is bent so as to expose an opposing surface to *each* surface of a platinum plate, as when a platinum plate, of the size of the former zinc, is similarly placed with respect to a plate of zinc of the same size as the former platinum, affording an economical method of arranging a Wollaston's battery, the zincs being bent round the coppers, in place of the coppers round the zincs.

"*Experiments with Grove's Battery.*

"The acid solutions were those recommended by Mr. Grove, i. e. pure nitric acid, in contact with the platina; sulphuric acid + 4·5 water by measure, in contact with the zinc. The surfaces of zincs immersed were 3 by 2·5 inches; those of the platina, bent round the porous vessel holding the zincs, were 6 by 2·5 inches. The glasses containing the acid, &c., were 3·2 inches long, 1·5 broad, 3·5 deep. The length of the porous vessel of pipeclay was 2·5 inches, the breadth 0·3, the depth 3·5. The number of alternations was five.

	Cubic Inches.
Time, 2 minutes,	8·0
The battery being at rest for 10 minutes,	8·0
,, ,, 25 ,,	3·0
,, ,, 1 hour,	1·0
,, ,, 19 hours,	none

"The porous vessel was found filled with sulphate of zinc, which stopped the action of the battery.

"*Second Experiment.*

"The zinc plates being of the same size as the former platina, and the platina of the same size as the former zincs, the zincs bent round the platina, all other things being as before.

	Cubic Inches.
Time, 2 minutes,	8·
After 10 minutes,	8·
,, 25 ,,	8·

"*Third Experiment.*

"Another battery, the diameter of the cells of which was 2½ inches, gave a diminution of only *one-half* of the quantity of gas after the lapse of *forty-eight hours*, shewing the advantage of having a large supply of sulphuric acid.*

"*Experiments with Smee's Battery of Platinized Silver.*

"The acid solution was of the same strength as before, and the sizes of the zincs and platinized silver the same as of the zincs and platina formerly employed. The zincs were bent round the platina.*

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* "The porous vessels were of pipeclay. The same expertments repeated with unglazed porcelain gave 10 cubic inches in two minutes; with very porous pipeclay, they gave as much as 15 cubic inches in two minutes, shewing the importance of attending to the nature of the porous vessel employed."

	Cubic Inches.
Time, 2 minutes,	3·
After 5 minutes,	2·6

"*Second Experiment.*

"The zincs being raised out of the acid, cut in two, and re-immersed.

	Cubic Inches.
Time, 2 minutes,	1·6
After 5 minutes,	1·6

"*Third Experiment.*

"The zincs and platinized silver being removed, the acid remaining untouched; the platinized silver plates were bent round the zincs.

	Cubic Inches.
Time, 2 minutes,	2·6
After 5 minutes,	2·4

"*Fourth Experiment.*

"The platinized silver cut in two.

	Cubic Inches.
Time, 2 minutes,	1·4
After 5 minutes,	1·4

"Supposing from these experiments the same quantity of electricity to be developed, whichever of the opposed surfaces of the two metals be the greater, I placed in separate glasses five zinc cylinders, one-inch diameter, immerged eight-tenths of an inch in the acid; platina foil, connected by binding screws with the zincs, was rolled into cylinders two-tenths of an inch in diameter, and then immersed in pipeclay tubes one inch deep.

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* "The most advantageous method of arranging a Smee's battery is, packing the zincs and platinized silvers in the manner recommended by Dr. Faraday in his 10th series, (also by Mr. Young, Phil. Mag. vol. x. p. 241,) placing the package on supports so as to allow the sulphate of zinc to fall to the bottom of the vessel, while the fresh acid rises to the surface."

	Cubic Inches.
Time, 2 minutes, ...	1·0
After 10 minutes, ...	1·0

"*Second Experiment.*

"Platina foil of the same size as the zincs, and zinc rods of the same diameter as the platina cylinders being employed, the effects were precisely the same.

	Cubic Inches.
Time, 2 minutes, ...	1·0
After 10 minutes, ...	1·0

"*Third Experiment.*

"The zinc cylinders being made twice the diameter of the former; the quantity of gas generated in two minutes was the same as before; the increased number of lines of electrical force compensating the increased resistance offered by the acid solution.

"*Fourth Experiment.*

"With cylinders twice the diameter of these, a very feeble current passed, the obstacle being too great to be overcome; by increasing the diameter of the porous vessels, and thereby of the nitric acid solution, which is a good conductor, the impediment is diminished, as shewn in experiment fifth. Thus Mr. Binks (Phil. Mag. vol. xi. p. 68) finds, that in dilute sulphuric acid, the size of the copper compared to a given surface of zinc, to produce a maximum effect, should be 16, that of the zinc to a given surface of copper being 7; while in a galvanic arrangement, in which the zinc is immersed in dilute sulphuric acid, inclosed in a membranous bag, and the copper in a surrounding solution of sulphate of copper, the proportion of zinc to copper was as one to eight, the impediment to the passage of the current being double in the latter case what it was in the former.

" *Fifth Experiment.*

" Five cylinders of zinc, 10 inches high, ½ diameter, were placed in glass vessels, containing sulphuric acid, as before. Into these were placed cylindrical earthenware vessels, 1½ inches diameter, containing pure nitric acid; slips of platina foil were rolled into cylinders as before.

	Cubic Inches.
Time, 2 minutes,	2·0
After 10 „	2·5
„ 30 „	3·0*

" From these data may be calculated the heights of the zinc pipes, and the weight of platina foil required to obtain any given decomposition, to be employed, as shewn by Jacobi, either as a motive power, or applied to light-houses, to the polariscope, or to the fusion of refractory substances. For the latter purposes, I had fixed to a strong, shallow woolf bottle, two tubes with glass cocks, and to them tubes containing chloride of calcium, applied to a Daniell's jet, playing upon a cylinder of lime, rotated by clock work. A third tube was inserted in the bottle, intended as a regulation of the pressure, or a safety valve, in case of explosion."

Dr. Apjohn then made a brief verbal communication on the subject of the Composition of Pyrope. This mineral, long

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* " The dilute acid in the voltameter began to boil; the cause of the increase of decomposition, compared to what took place in the small cylinder, was the small stratum of sulphuric acid between the porous vessel and the zinc. For a continuous action the zinc pipes, sealed at one end and amalgamated, should be connected by pipes at top and bottom, with an earthenware vessel, containing the sulphuric acid."